

### **REMARKS**

In view of the Notice of Non-Compliant Amendment dated February 1, 2010, Applicant requests entry of this Supplemental Amendment instead of the Amendment filed on November 13, 2009. Applicant requests that the amendment filed on November 13, 2009 not be entered. Applicant believes the claims filed in this Supplemental Amendment to be compliant under 37 CFR 1.121.

Claims 1-5, 7-23, 25-31, 36-64, 66, 67, and 69-72 were pending in the application with claims 1-5, 7-22, 43-46, 50-64, 66, and 67 being withdrawn. Claims 23, 25-31, and 40-42 have been amended. Claims 1-5, 7-22, 26, 43-46, 50-64, 66, 67, and 72 have been canceled. New claim 73 has been added. No new matter has been added. Claims 23, 25, 27-31, 36-42, 45-49, 65, and 73 are now pending for examination with claims 23 and 25 being independent.

### **Notice of Non-Compliant Amendment**

In the Notice of Non-Compliant Amendment, the Examiner notes that claim 40 does not meet the requirements of 37 CFR 1.121. The Examiner also notes that all claims being currently amended in an amendment paper need to be submitted with markings to indicate the changes that have been made relative to the immediate prior version of the claims.

In this resubmission, claim 40 includes the text of deleted matter shown by strike-through and double brackets placed before and after deleted characters having five or fewer consecutive characters. Accordingly, the claims filed herein should be compliant under 37 CFR 1.121.

### **Interview Summary**

Applicant notes with appreciation the telephonic interview held between Kuangshin Tai and Examiner Cooney on January 25, 2010. Based on the Interview Summary mailed on February 1, 2010, Applicant has complied with the Examiner's suggestions, as indicated below.

The Examiner noted that if claims 23 and 25 were amended to include "in an amount comprising at least about 2% by weight based on the total weight of the cross-linked metal oxide or silicon oxide based sol-gel material" after the first usage of the term "cross-linking agent," claims

23 and 25 would overcome the rejections over the art. Accordingly, independent claims 23 and 25 were amended, as suggested by the Examiner, and should be in condition for allowance.

The Examiner also noted that, on resubmission, the second word of new claim 73 should recite the term "aerogel" rather than "sol-gel," in order to avoid antecedent basis issues. Accordingly, in this resubmission, the second word of new claim 73 recites "aerogel" instead of "sol-gel," as suggested by the Examiner, and no longer raises antecedent basis issues.

#### Claim 40

Applicant has amended claim 40 to recite drying to be "carried out using at least one of solvent exchange, supercritical drying, or a process that does not involve supercritical drying." Support for this claim can be found, at least, in Fig. 6 and paragraphs [0046] and [0087] of the published specification. Because claim 40 depends from independent claim 25, this claim should be in condition for allowance.

#### Initial Comments on Claims

The Office Action requested the Applicant clarify the language of claims 26-31 to clearly indicate that the claimed ranges of % by weight values for their cross-linking agent are "based on the weight of the aerogel that is cross-linked".

Claims 26-31 have been amended to recite that the cross-linking agent comprises at least about [a percentage] by weight based on the total weight of the cross-linked metal oxide or silicon oxide based sol-gel material. Accordingly, claims 26-31 clearly indicate that the claimed ranges of a percentage by weight values for the cross-linking agent are based on the total weight of the cross-linked metal oxide or silicon oxide based sol-gel material.

#### Rejection of Claims 23, 25-31, 36-42, 47-49 and 69-72 Under 35 U.S.C. §112, First Paragraph

Claims 23, 25-31, 36-42, 47-49 and 69-72 were rejected under 35 U.S.C. §112, first paragraph, as failing to comply with the written description requirement.

Claim 23 has been amended to recite contacting the metal oxide or silicon oxide based sol-gel preformed material with an organic cross-linking agent, the cross-linking agent comprising an

organic compound that provides an organic surface layer chemically bound to surfaces of said metal oxide or silicon oxide based sol-gel preformed material.

Similarly, Claim 25 has been amended to recite said metal oxide or silicon oxide based sol-gel preformed material having a surface layer of an organic substance formed by chemical bonding of an organic cross-linking agent to surfaces of said metal oxide or silicon oxide based sol-gel preformed material after formation of said metal oxide or silicon oxide based sol-gel preformed material so as to form said cross-linked metal oxide or silicon oxide based sol-gel material.

Written description support for a surface layer that is chemically bound to surfaces of the metal oxide or silicon oxide based sol-gel preformed material can be found in the specification, discussed below. In particular, the specification describes a cross-linking agent that chemically binds to the surface of the metal oxide or silicon oxide based sol-gel preformed material to form a surface layer on the preformed material.

According to the specification, the preformed material includes a contour surface of silica that can be used as a template for deposition and growth of a cross-linking polymer for reinforcement of interparticle necks (see paragraphs [0030] and [0073] of the published application). Also provided in the specification, a cross-linking agent is an agent that forms a bond with a reactive side group on a sol-gel like material (see paragraphs [0015], [0061], and [0062] of the published application). When the cross-linking agent contacts the metal oxide or silicon oxide based sol-gel preformed material, chemical bonds are formed between the cross-linking agent and the contour surface of the preformed material so that deposition and growth of a surface layer may occur.

The specification describes the preformed material as having monolayer coverage, for example, having 4.7 monolayers or more (see paragraphs [0069] and [0071] of the published application). Such monolayer coverage provides clear indication of a surface layer that is formed on the preformed material.

In addition, the cross-linking agent is introduced conformally to secondary particles of the preformed material in the form of a surface layer (see Fig. 2B and paragraph [0069] of the published application). One of skill would interpret secondary particles to be a structural unit of the preformed material (see paragraph [0030] of the published application). Therefore, conformal

introduction of the cross-linking agent to the preformed material gives further support for inclusion of a surface layer on the preformed material.

To serve as further indication that the cross-linking agent is chemically bound to reactive groups on the surface of the preformed material in forming a surface layer, an example using di-ISO as a cross-linking agent provides experimental data showing the lack of the dominant urethane C=O stretch ( $\sim 2272\text{ cm}^{-1}$ ) in an IR analysis, associated with the reactive end groups of the cross-linking agent. This data indicates that the cross-linking agent has bonded chemically to reactive groups on the surface of the preformed material, which is consistent with a surface layer being formed on the preformed material.

Because the specification provides sufficient written description support for a surface layer that is chemically bound to surfaces of the metal oxide or silicon oxide based sol-gel preformed material, the rejections of independent claims 23 and 25 on this ground should be withdrawn. The remaining pending claims 26-31, 36-42, 47-49, and 69-71 that stand rejected on this ground depend from independent claim 25 and are thus sufficiently supported by the written description.

Accordingly, Applicant respectfully requests withdrawal of the claim rejections on this ground.

Rejection of Claims 23, 25-31, 36-42, 47-79 and 69-72 Under 35 U.S.C. §112, Second Paragraph

Claims 23, 25-31, 36-42, 47-49 and 69-72 were rejected under 35 U.S.C. §112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicant regards as the invention.

As discussed above, claims 23 and 25 have been amended to replace “conformal coating” with “surface layer.” Applicant believes the amendment to address the rejection.

Accordingly, Applicant respectfully requests withdrawal of the claim rejections on this ground.

Rejection of Claims 23, 25, 36, 39-42, 47-49 and 69-72 Under 35 U.S.C. §102(b)

Claims 23, 25, 36, 39-42, 47-49 and 69-72 were rejected under 35 U.S.C. §102(b) as being anticipated by "*Low-Density, Mutually Interpenetrating Organic-Inorganic Composite Materials via Supercritical Drying Techniques*", *Chem. Mater.*, 1994, pgs. 282-286 (Novak).

As discussed above, claim 23 has been amended to recite that the organic surface layer is chemically bound to surfaces of the metal oxide or silicon oxide based sol-gel preformed material. Claims 25 has been amended to recite that the surface layer of an organic substance is formed by chemical bonding of an organic cross-linking agent to surfaces of the metal oxide or silicon oxide based sol-gel preformed material.

Novak fails to disclose the surface layer feature. Instead of a surface layer chemically bound to surfaces of a metal oxide or silicon oxide based sol-gel preformed material, the crosslinks of Novak form interpenetrating networks (IPNs) which are separate from the preformed material (see p.283 of Novak). Moreover, it would not have been obvious to modify the crosslinks of Novak to include a surface layer because the reference is focused on creating IPNs in aerogel materials and such modification would defeat the intended purpose of the IPNs taught by Novak.

Accordingly, Applicant respectfully requests withdrawal of the claim rejections on this ground.

Rejection of Claims 23, 25, 36-42, 47-49, 69, 70 and 71 Under 35 U.S.C. §102(a)

Claims 23, 25, 36-42, 47-49, 69, 70 and 71 were rejected under 35 U.S.C. §102(a) as being anticipated by "*Fabrication and Thermophysical Characterization of Nano-Porous Silica-Polyurethane Hybrid Aerogel by Sol-Gel Processing and Supercritical Solvent Drying Technique*", *Korean J. Chem. Eng.*, 2002, pgs. 159-1669 (Yim).

As discussed above, claim 23 has been amended to recite that the organic surface layer is chemically bound to surfaces of the metal oxide or silicon oxide based sol-gel preformed material. Claim 25 has been amended to recite that the surface layer of an organic substance is formed by chemical bonding of an organic cross-linking agent to surfaces of the metal oxide or silicon oxide based sol-gel preformed material.

Yim fails to disclose the sol-gel preformed material. Instead, Yim teaches use of a partially condensed solution which one of skill in the art would understand to be a viscous liquid-phase silica

oil of the type produced by the method of Tillotson and Hrubesh (see “Transparent Ultralow-Density Silica Aerogels Prepared by a Two-Step Sol-Gel Process”, Tillotson, T. M. and Hrubesh, L. W., Journal of Non-Crystalline Solids, 1992, 145(1-3), 44-50) that is not a sol-gel preformed material (see p.161 of Yim). For example, the partially condensed solution of Yim is different from a sol-gel preformed material in that the partially condensed solution does not include a rigid three dimensional network of interconnected particles exhibiting a mesoporosity. Moreover, Yim fails to disclose the surface layer feature. Instead of a surface layer chemically bound to surfaces of a metal oxide or silicon oxide based sol-gel preformed material, Yim discloses a hybrid aerogel that incorporates no such surface layer. Further, it would not have been obvious to modify the partially condensed solution of Yim to include a surface layer because incorporation of a cross-linking agent would not result in a surface layer that is chemically bound to surfaces of a sol-gel preformed material and such modification would defeat the intended purpose of the partially condensed solution for creating a hybrid aerogel taught by Yim.

Accordingly, Applicant respectfully requests withdrawal of the claim rejections on this ground.

Rejection of Claims 26-31 Under 35 U.S.C. §103(a) over Yim

Claims 26-31 were rejected under 35 U.S.C. §103(a) as being unpatentable over Yim.

Claims 26-31 depend from claim 25 which is patentable over Yim for reasons noted above. Therefore, claims 26-31 are patentable over Yim.

Accordingly, Applicant respectfully requests withdrawal of the claim rejections on this ground.

Rejection of Claims 26-31 Under 35 U.S.C. §103(a) over Novak

Claims 26-31 were rejected under 35 U.S.C. §103(a) as being unpatentable over Novak.

Claims 26-31 depend from claim 25 which is patentable over Novak for reasons noted above. Therefore, claims 26-31 are patentable over Novak.

Accordingly, Applicant respectfully requests withdrawal of the claim rejections on this ground.

**CONCLUSION**

A Notice of Allowance is respectfully requested. The Examiner is requested to call the undersigned at the telephone number listed below if this communication does not place the case in condition for allowance.

If this response is not considered timely filed and if a request for an extension of time is otherwise absent, Applicant hereby requests any necessary extension of time. If there is a fee occasioned by this response, including an extension fee, the Director is hereby authorized to charge any deficiency or credit any overpayment in the fees filed, asserted to be filed or which should have been filed herewith to our Deposit Account No. 23/2825, under Docket No. A0958.70000US00.

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Respectfully submitted,

By 

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